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RADIATION PROTECTION CULTURE: A GLOBAL CHALLENGE

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The central motto 'Radiation Protection Culture—A Global Challenge' of the fourth European IRPA Congress is discussed on the basis of the IRPA Guiding Principles Establishing a Radiation Protection Culture and the contributions presented in the plenary sessions of the conference.

INTRODUCTION

The fourth European IRPA Congress was organised by the Association romande de radioprotection (ARRAD) and the German-Swiss Radiation Protection Association (Fachverband für Strahlenschutz, FS) at the Centre International de Conférences Genève in Geneva from the 23rd to 27th of June 2014. A total of 636 participants from 48 countries followed the invitation of the congress president Klaus Henrichs. The European IRPA Societies participants used the congress to discuss their future work in an IRPA Associate Societies Forum.

The choice of the congress location in Geneva was favoured by the generous sponsorship of the Swiss government and the opportunity for a close cooperation with international organisations. Four side events took place: a Workshop on Data Collection organised by UNSCEAR, WHO and IRPA, a Lunchtime Seminar: Radiation Protection in Pediatric Imaging by WHO, the General Assembly of the European NERIS Platform and a Workshop on Radiation Protection Principles on Similarities and Differences in Ionizing and Non-ionizing Radiation by ICNIRP and WHO.

Two hundred and ten early risers used the chance to participate in 10 refresher courses in order to get an up-to-date view of the newest developments in radiation protection (RP) and 231 participated in excursions to CERN.

Not to forget, an art exhibition gave the congress a special flavour. Textile artists from around the world had been invited to display their artistic approach to the theme 'Radiation'. The quilts exhibited an impressive view of the variety of associations and interpretations connected to radiation in the minds of non-professionals ranging from the beauties to the perils of radiation.

This report gives a personal view of some of the organisers surveying how the motto of the congress 'Radiation Protection Culture—A Global Challenge' was dealt with in the plenary sessions. Any misperception of the reported contents of the contributions is solely the fault of the authors.

IRPA GUIDING PRINCIPLES

The motto was chosen because of IRPA's efforts to develop Guiding Principles for Establishing a Radiation Protection Culture (RP culture). Following a French initiative presented during the 2008 IRPA Congress in Buenos Aires, the Guiding Principles[(1)] were officially presented by Roger Coates on behalf of Bernard Le Guen[(2)] at the congress and provided an opportunity for celebrating IRPA's 50th anniversary.

The Guiding principles were developed in an inclusive and consultative approach involving all the stakeholders. The document aims at both fostering a belief in the success of a cultural approach and providing guidance to help equip RP professionals to promote a successful RP culture in their organisation and workplace.

According to IRPA, embedding RP at a cultural level within an organisation is by far the most effective way of delivering the performance to which we all aspire. The concept of culture relates to the ideas, beliefs and customs that are shared and accepted by people in a society.

There are several possible development stages of RP culture. One such model can be said to include three main developmental stages: basic compliance, self-directed safety compliance and a behavioural safety system.

Strong leadership, education and training, establishment of a positive behaviour at the working place and proper communication among all practitioners have a definite impact on RP culture. Similarly, learning from events, incidents and near misses is an important part of culture development.

The IRPA Associate Societies shall have a key role in supporting the RP professional who is in the front line in the promotion of RP culture.

The IRPA Guiding Principles are targeted at RP professionals rather than the public at large. The interface between professionals and the public is also addressed in these guiding principles in a separate chapter on stakeholder engagement, but it should also be addressed through RP professionals' communication to the public and in regulatory requirements.

IRPA has endeavoured to define elements and traits of an RP culture, which encompasses a pattern of knowledge (scientific, technical, ethical, historical, practical, etc.) and behaviours (questioning attitude, personal accountability, integrity, modesty, engagement with stakeholders, openness and adaptable, transparent and exemplary behaviour). RP culture is a combination of science, values and ethics (i.e. equity), as well as experience. The RP culture principles include the well-established justification, optimisation and dose limitation principles and also include the sharing of competence by training and education.

FOUR ASPECTS OF CULTURE

What is meant by culture? Culture comprises the ideas, beliefs and customs that are shared and accepted by people in a society. That complex whole, which includes knowledge, belief, art, morals, law, customs, values, symbols, rituals and any other capabilities and habits, acquired by people as members of society that determine appropriate attitudes and behaviour.

As discussed during the development of the IRPA Guiding Principles, culture has four basic aspects[3]:

- The *content* comprises attitudes, beliefs, knowledge, perceptions, values, goals and ethics.
- The *categorial and practical aspect* covers requirements and standards, systems and organisations, practical embodiment and behaviour.
- The *societal aspect* deals with the society as a culture bearer and its internal and external perception.
- For guaranteeing the *heritage and future*, a culture has to be bequeathed to others, nurtured and fostered. Tradition has to be conveyed; historical awareness has to be maintained, likewise avoiding stagnation and caring for shaping the future.

These aspects are all covered by the IRPA Guiding Principles and were also dealt with at the congress. For implementing the motto, the congress was arranged around a series of 7 plenaries with 19 invited speakers. Invited and keynote speakers also opened the thematically ordered parallel sessions allowing again for emphasising important aspects of RP culture.

THE PILLARS OF RADIATION PROTECTION

RP is based on three pillars, i.e. science, principles and recommendations and practical implementation in international standards and regulations. These three pillars provide the basis on which any RP culture has to evolve.

The plenaries started with Jacques Lochard[4] who presented an overview over the ongoing efforts of ICRP's committee 4 regarding the ethical basis of RP. He stressed that the importance for ICRP to adopt a 'cross cultural' approach as international recommendations must be broadly applicable worldwide. The system of radiological protection is rooted in three major theories of ethics: virtue, deontological and consequentialist/utilitarian ethics. A set of ethical values common or at least acceptable to the widest possible range of cultures have been identified which fairly well agree with ICRP's principles of RP:

- beneficence and non-maleficence: do more good than harm,
- prudence and reasonableness: keep exposure as low as reasonably achievable (ALARA),
- justice, tolerability and equity: do not exceed the levels judged socially unacceptable and reduce inequities in the dose distribution and
- dignity and autonomy: treat people with respect and involve stakeholders.

In contrast to the new term RP culture, the term safety culture is meanwhile well-established; see reference (3) for definition and development. RP culture can be regarded as part of the general industrial safety culture. But, it extends far beyond that since radioactivity and radiation require RP in medicine, research and in daily life. The RP culture must offer a consistent system for all fields of application.

Jean-Luc Christophe[5] put the question what can be learnt for radiological and nuclear safety from other 'safe' industries such as air traffic. Emphasising human error as a major threat to safety, he showed how safety culture in various fields of applications serves as a common basis for improving safety.

Malcolm Crick[6] explained how the scientific findings are evaluated by UNSCEAR. He stressed that independence and scientific objectivity are the basic qualities when UNSCEAR provides the scientific basis for protection. However, he pointed to the problems that more clarity is needed over the science −policy interface and to the difficulty to communicate confidence in science. He made in particular a point that statements about attribution of radiation-induced effects have to be made with outmost care and that the feedback between policy and science has to be improved. Finally, he raised the issues of quantities and units that need to be addressed with the outmost care. Changes must do more good than harm.

John Harrison[7] explained the role of ICRP and how principles and recommendations evolve from the scientific basis. The objective is to manage and control exposures to ionising radiation so that deterministic effects are prevented and the risks of stochastic effects are reduced to the extent reasonably achievable.

Augustin Janssens[8] described the implementation of the actual ICRP recommendations into the 2014 IAEA Basic Safety Standards and the EU Directive 2013/59/EURATOM. The IAEA BSS and the Euratom Directive reflect a coherent philosophy for the protection of all categories of exposed individuals in all exposure situations. It benefited very much from ICRP Publication 103, but there are subtle differences that need to be explained. The approach in the international standards may contribute to a better understanding of RP. The speaker emphasised that in addition to developments in science societal aspects, ethics, communication, decision-making and imposing dose limits, which are a matter of regulatory enforcement, also need universal acceptance.

LESSONS LEARNT FROM EMERGENCIES

Any culture has to prove its value during crises. Learning from accidents is a crucial point of cultural development. This aspect was covered in this plenary.

Toshimitsu Homma[9] presented the experiences made in Japan after the Fukushima accident and the lessons learnt for emergency preparedness and response. He stressed that:

- arrangements should be established for taking precautionary urgent protective actions before a release on the basis of plant conditions,
- advance preparation for safe evacuation of special facilities is necessary (designation of medical teams and hospitals, and methods of transportation in advance),
- sheltering indoors should be conducted only for a short period until either safe evacuation or termination of sheltering is possible and
- consistent policies and criteria for implementation of urgent and long-term measures including return to normality should be established in advance.

For restrictions on food and drink during the crisis management of the early phase, triggers should be used to make decisions on restrictions of intake for food and water. Long-term restrictions on food and drink should be discussed in the justification and optimisation process of the overall protective action strategy, taking into account the actual radiological conditions of the affected area.

A general lesson learned from the Fukushima accident is that there was an implicit assumption of both the operators and the regulatory authorities that such severe accidents could not happen and thus enough attention had not been paid to preparedness for such accidents. Both the operators and the regulatory authorities were satisfied with the current level of preparedness for emergency and failed to continuously improve the arrangement for emergency preparedness and response.

Wolfgang Weiss[10] gave an overview over the international efforts after the Fukushima accidents. He stressed the application of ICRP Publicaton 109: 'Plans should be prepared for all types of emergency exposure situations; the level of detail within a plan will depend on the level of threat posed and the degree to which the circumstances of the emergency can be determined in advance'. This implies that preparedness should not be based on the probability of an accident but on the potential outcome with the goal to prevent deterministic effects and to reduce stochastic risks to a level reasonably achievable. Based on the UNSCEAR Report on the consequences of the Fukushima accident, he stated: 'No radiation-related deaths or acute diseases have been observed among the workers and general public exposed to radiation from the (Fukushima) accident. No discernible increased incidence of radiation-related health effects are expected among exposed members of the public or their descendants. The most important health effect is on mental and social well-being, related to the enormous impact of the earthquake, tsunami and nuclear accident, and the fear and stigma related to the perceived risk of exposure to ionizing radiation. Effects such as depression and post-traumatic stress symptoms have already been reported. Estimation of the occurrence and severity of such health effects are outside the Committee's remit'. He concluded that there is the need for a conceptual framework, which takes into account BOTH the aspects of radiological protection and of the additional factors that are generally unrelated to radiological protection, including aspects of public health protection, in preparedness and response with the ultimate goal of mitigation of serious psycho-social and other consequences arising from nuclear accidents.

Not all accidents are national or global disasters, notwithstanding that they may be disastrous on the individual level. This is frequently the case in medical incidents and accidents. Michel Bourguignon[11] presented the lessons learnt from accidents in the medical field. In a large number of examples, he demonstrated the lack of radiological safety culture in hospitals and concluded that incidents and accidents of radiotherapy and interventional radiology result mostly from human errors not controlled in a context of poor and failing organisation. He pointed out the essentials to improve the situation by implementing cultural assets of safety and RP in medicine.

INTERACTION WITH SOCIETY

The plenary 'Interaction with Society' demonstrated the variety of problems an RP culture will face when coping with society at general. Jacques Repussard[12] dealt with this issue from the viewpoint of international and European emergency management. Emergency management has to comprise the capabilities to

anticipate correctly the evolution of the situation in order to take the right decisions at the right time, at the nuclear facility, to remain in control of the situation in different timescales.

During the post-accident phase, when the society and economy have to cope with the consequences of radioactive contamination, and the consequences of the fear of contamination and those of the relocation of parts of the population, it is essential to generate long-term trust within society on the validity of emergency management and protection measures and to co-operate actively with the international community whilst coping with a complex situation in the country.

He presented the French methodology of emergency preparedness and concluded that the understanding of all consequences (and why these consequences occurred) of radiological emergency situations needs further research beyond the safety or RP-specialised fields since such emergency situations can be extreme. Sharing internationally broad lessons from such rare events as the Fukushima accident is probably more important than trying to harmonise technical protocols, protection limits, etc., which need to be suited to the actual situation caused by an accident, different by nature from case to case. For a more economically and societally efficient crisis management, once the initial emergency phase is over, it will be essential to take stakeholders on board for decision-making processes and to provide meaningful information to the public.

Tanja Perko[13] pointed to communication as an underdeveloped aspect of RP and requested the RP society to improve the situation. Her take-home messages were as follows:

- to invest more in the R & D of interaction and communication with society,
- to promote a trans-disciplinary approach in RP: natural science and social science and humanities and
- to integrate social aspects into RP research.

The knowledge in the public about ionising radiation is rather low. However, she opposed to what she called the researchers', industries' and authorities' views that this deficit could be cured by educating the general public and by explaining them the facts and by assisting people to better understand nuclear technology. This Knowledge Deficit Model ('Let's educate emotional and radio-phobic people'.) has shown to result in a lack of mutual learning. She proposed in addition an Emotional Deficit Model, which satisfies the citizens' views that they miss the recognition by industry, research and authorities of being a competent stakeholder.

The citizens miss empathy and the RP community has to face the obstacle that human behaviour is primarily driven by perceptions and not by facts. She concluded with the plea that interactions with society and communication concern the entire RP community and that her take-home messages mentioned above might improve this communication. The authors interpreted her plea as a mix of both models with the cultural capabilities to emphasise, care, educate and involve.

Katrine Kirk[14] presented, on behalf of the WHO Patients for Patient Safety (PFPS) Program, the problems patients face in connection with their treatment with radionuclides and ionising radiation. She argued in a very personal and emotional way for the development of a safety and RP culture in which patients, medical practitioners and nursing staff together strive towards a better RP.

Radiation safety issues concern not just the risk of radiation itself but a risk to health seen from the patient perspective. She questioned in a certain way the principles of RP in medicine when mentioning the problems faced during the daily routine of health care such as: lack of access to information, delays of imaging, misinterpretations, unnecessary tests and ineffective treatment, errors in execution of tests and treatments, unacceptable effects of treatment and side effects from overuse. She showed severe deficits which only can be overcome by a cultural effort which follows the recommendations:

- Involve patients in their own care!
- Involve your own patients at organisational level for quality improvement!
- Strengthen the safety culture by learning from the patient experience!

In conclusion, she recommended to work with patient organisations like the WHO PFPS initiative (www.who.int/patientsafety/patients_for_patient/en/) to develop better communication tools to use with patients, to better train the staff and to advocate for improvements at the policy level.

FOSTERING RADIATION PROTECTION

Axel Böttger[15] reported on the results of the 2012 International Conference 'Radiation Protection in Medicine' at Bonn and how the implementation of the so-called Bonn Call for Action 2012 proceeds. Objectives of this call were to:

- attain the highest benefit with the least possible risk to patients by appropriate use of ionising radiation for diagnosis and treatment,
- improve radiological protection of patients and health workers,
- fully integrate radiological protection in health care systems,
- improve the benefit—risk dialogue with patients and public and
- enhance the safety of technical operations and to reduce human and technical errors.

Ten actions were regarded as necessary at the Bonn Conference. Of them Action 8: 'Strengthen radiation protection culture in health care' contained the cultural aspect:

- establish patient safety as a strategic priority in medical uses of ionising radiation and recognise leadership as a critical element of strengthening radiation safety culture;
- foster closer co-operation between radiation regulatory authorities, health authorities and professional societies;
- foster closer co-operation on RP between different disciplines of medical radiation applications as well as between different areas of RP overall, including professional societies and patient associations;
- learn about best practices for instilling a safety culture from other areas, such as the nuclear power industry and the aviation industry;
- support integration of RP aspects in health technology assessment;
- work towards recognition of medical physics as an independent profession in health care, with RP responsibilities;
- enhance information exchange among peers on RP and safety-related issues, utilising advances in information technology.

As the president of the Bonn Conference Wolfgang Weiss stated: 'There is a need for a holistic approach which includes partnership of national governments, civil society, international agencies, researchers, educators and professional associations dedicated to identifying, implementing and advocating solutions and leadership, harmonization and co-ordination of activities and procedures at international level'.

As in medicine, improving RP is a permanent task regarding occupational exposures. Caroline Schieber[16], as chair of the programme committee of the International Conference on Occupational Radiation Protection: Enhancing the Protection of Workers—Gaps, Challenges and Developments, which will take place in Vienna, Austria, 1–5 December 2014, presented her view of goals and contents of the upcoming conference. The IRPA Guiding Principles will be a particular topic in the conference.

Fostering RP means also to bring it into the society as general. Here, the radiation exposure to radon at homes is an aspect that should concern everybody. John Harrison[17] presented the topic from the standpoint of ICRP and also explained ICRP's considerations regarding the dosimetry of radon exposure. Hestated:

- There are good epidemiological data on lung cancer and radon exposures in homes and mines.
- The risk of lung cancer in homes and other buildings is to be controlled on the basis of radon concentrations in becquerel per cubic meter rather than on dose.
- ICRP will publish dose coefficients for inhalation and ingestion of radon isotopes, giving values for indoor workplace, mines and homes.
- ICRP's upper Reference Level of 300 Bq m^{-3} for homes will likely be equivalent to an effective dose of 18 mSv.

PROTECTION AGAINST NON-IONISING RADIATION

The organisers of the congress were glad to make—in cooperation with ICNIRP—RP against non-ionising radiation (NIR) likewise an important topic of the congress. Maria Feychting[18] surveyed the epidemiological findings and their consequences for RP against NIR. Karl Schulmeister[19] emphasised the challenges of protection against optical radiation.

Zenon Sienkiewicz[20] showed the multitude of existing and upcoming applications of NIR in medicine and the problems with respect to RP related to them. He pointed out the need for specific guidelines limiting exposure of patients and health care workers in medicine (including aesthetic uses) in order to provide an appropriate level of protection against detrimental effects, to avoid unintended overexposures not unduly limiting benefits associated with exposure. His recommendations also favoured a cultural approach that runs well in agreement with RP against ionising radiation.

His recommendations comprised among others:

- training for health care workers covering all applications: static magnetic fields, low-frequency magnetic fields, radiofrequency fields, optical radiation and ultrasound,
- awareness of all aspects of safety (including specific devices such as class 3 or 4 lasers for cosmetic purposes) with clear effective messages to end-users about hazards and risks,
- developing science-based, global and harmonised guidelines with a coherent, consistent protection philosophy for all fields (WHO is investigating the possibility of a BSS for NIR) and, finally,
- maintaining for NIR applications the principles of RP against IR: justification of practice, optimisation of protection and limitation of exposures.

CONTRIBUTED PAPERS

Beyond the scope of design of the programme of a congress are the interests of those who submit a contribution. Until October 2013, there were 369 abstracts submitted. The abstracts were reviewed and ranked by representatives of the European IRPA Societies and were arranged by the International Program Committee in parallel and poster sessions

according to this ranking. In total, 115 invited or keynote contributions were chosen for the parallel sessions. The parallel sessions dealt with the topics in proportion to the frequency of the respective topic in the contributed abstracts. In a panel discussion, the issue of implementation of the system of RP was controversially discussed. Ordered according to their topics, the contributions demonstrated that the predominant majority of the participants considered just two aspects of RP culture as their topics, namely those of content and categorical and practical. With respect to content, the biological effects of ionising and NIR, measurements and dosimetry as well as radioecology and environment were in the focus of the participants.

In view of the categorical/practical aspects, the hot topics were fundamentals and regulations, implementation of the system of protection—also with regard to the new Euratom BSS—, protection of workers, the general public, of patients in diagnostic and therapeutic applications of radioactivity and radiation, the protection of medical personal as well as emergency management and nuclear safety and security. It was particularly pleasing that there was high interest in RP in medicine and that RP against NIR could be made an integral part of the congress.

A total of 244 contributions were presented as posters. Due to the generous offer of space and time—but also due to the quality of the poster contents—the poster sessions were well visited. A number of poster and oral contributions were selected on the basis of a review by the International Program Committee for regular publication in RPD (this issue).

AWARDS

Societal aspects and the question for heritage and future were underrepresented in the contributions in spite of their importance for the future of an RP culture and that of the quality of the respective contributions. A highlight was in this respect certainly the competition for the Young Scientists and Professionals Award (YSPA). Twelve of the European IRPA associate societies had nominated the winners of their national competitions as candidates for the YSPA. The YSPA Committee chaired by Alfred Hefner had to judge about the competition. A whole day was spent for the presentations of the excellent contributions by the candidates. The decision was to grant the award three times. The highest award was granted to Lukas Jägerhofer 'Radiation Protection for the MedAustron facility'. The second award was granted two times to Fabien Panza 'Mobile in situ gamma spectrometry for environmental contamination monitoring: marcassin system' and Lieven Vervecken 'Dynamic external dose assessment by LES modelling of radioactive pollutant dispersion over an open field'. The competition for theYSPA has become an inherent part of all IRPA congresses. It emphasises the importance IRPA and its associated societies attach to the promotion of young scientists and professionals.

In order to emphasise the relevance of the posters for the congress, four poster awards were granted. The International Poster Award Committee chaired by Christophe Murith selected the poster awardees Haruyuki Ogino 'Experience of information dissemination on RP after the Fukushima accident', François Trompier 'Overview of physical dosimetry methods for triage application integrated in the new European network RENEB', Gernot Butterweck 'Utilizing gaseous emissions of a proton accelerator facility as tracer for small-scale atmospheric dispersion' and Franz Kabrt 'Radon soil gas measurements and evaluation of relevant data for the prediction of an area's Radon potential'.

CLOSING AND CONCLUSIONS

In a panel during the closing plenary Renate Czarwinski (IRPA), Hans Menzel (ICRU, ICRP), Shengli Niu (ILO), Maria del Rosario Perez (WHO), Miroslav Pinak (IAEA) und Ferid Shannoun (UNSCEAR) formulated their standpoints and commented the results of the congress as far as relevant for the future work of their organisations.

One of the authors (R. M.) summarised the congress at the end and used this opportunity to ask the provoking question whether or not RP culture will be just a subculture in our societies. Pointing to existing discrepancies between the cultural claim of RP and the reality of the extremely negative and fearful perception of radioactivity and radiation in large parts of our societies, this question should not be overlooked by IRPA but rather be aggressively approached. It is essential for a future of RP culture that every endeavour should be made to fight the frequently observed culture of radiation fears and to promote RP culture as an integral part of our general culture.

The implementation of an RP culture will be an ambitious undertaking. According to Roger Coates[2], the new Guidance is a symbol for the IRPA anniversary: from the past, towards the future, but with a common culture. The fourth European IRPA Congress has opened the stage for the practical application of the Guiding Principles by the European Associate Societies. Now, they have to prove their value in practice.

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